www.water-alternatives.org Volume 4 | Issue 3
Sally, H.; Lévite, H. and Cour, J. 2011. Local water management
of small reservoirs: Lessons from two case studies in Burkina Faso.
Water Alternatives 4(3): 365-382

Local Water Management of Small Reservoirs: Lessons from Two Case Studies in Burkina Faso

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ABSTRACT: Burkina Faso is actively pursuing the implementation of Integrated Water Resources Management (IWRM) in its development plans. Several policy and institutional mechanisms have been put in place, including the adoption of a national IWRM action plan (PAGIRE) and the establishment so far of 30 local water management committees (Comités Locaux de l'Eau, or CLE). The stated purpose of the CLE is to take responsibility for managing water at sub-basin level. The two case studies discussed in this paper illustrate gaps between the policy objective of promoting IWRM on the one hand, and the realities associated with its practical on-the-ground implementation on the other. A significant adjustment that occurred in practice is the fact that the two CLE studied have been set up as entities focused on reservoir management, whereas it is envisioned that a CLE would constitute a platform for sub-basin management. This reflects a concern to minimise conflict and optimally manage the country's primary water resource and illustrates the type of pragmatic actions that have to be taken to make IWRM a reality. It is also observed that the local water management committees have not been able to satisfactorily address questions regarding access to, and allocation of, water, which are crucial for the satisfactory functioning of the reservoirs. Water resources in the reservoirs appear to be controlled by the dominant user. In order to correct this trend, measures to build mutual trust and confidence among water users 'condemned' to work together to manage their common resource are suggested, foremost of which is the need to collect and share reliable data. Awareness of power relationships among water user groups and building on functioning, already existing formal or informal arrangements for water sharing are key determinants for successful implementation of the water reform process underway.

KEYWORDS: Small reservoirs, integrated water resources management, water user association, irrigation, water allocation, conflicts, power relationships, Burkina Faso

INTRODUCTION

Burkina Faso is one of the poorest countries in the world, with nearly half the population (46% in 2004) living below the poverty line.[1] The agriculture sector contributes about 35% to the country's GDP[2] and accounts for about 80% of employment (INSD, 2011). The rainfall regime in Burkina Faso is irregular and unevenly distributed. There are few perennial rivers and exploitation of groundwater remains limited. Furthermore, the country is subjected to periodic extreme events of droughts and floods. Limiting the consequences of recurring droughts has always been high on the development agenda of the

[1] CIA World Factbook, www.cia.gov/library/publications/the-world-factbook/geos/uv.html. Definitions of poverty vary among countries but a level of US$1 per person per day is usually set for countries with income levels like that of Burkina Faso.
[2] Estimated at US$517 per capita in 2009 (World Bank, 2011).

government and has notably underpinned considerable investments in hundreds of small reservoirs that support livelihoods including agriculture, livestock and domestic water use (Boelee et al., 2009).

Water is considered as the cornerstone of Burkina Faso's rural development programmes (Burkina Faso, 2010). Like several other African countries, Burkina Faso has embarked upon the development of an ambitious water policy framework and an action plan with a focus on Integrated Water Resources Management, IWRM (MAHRH, 2003).

It may be useful to recall that the notion of IWRM is built upon the principles that emerged from the Dublin and Rio conferences of 1992 concerning nested water management at local, national and international levels. The Global Water Partnership (GWP), established shortly after in 1996, is one of the leading proponents of IWRM, working through its extensive network of national, regional and international partners. According to Petit and Baron (2009, citing Ghiotti, 2005),

> donors and international agencies who have been key players in the promotion of IWRM redefined their policies based on a three-pronged approach: a principle, the 'right price'; a method, participation and decentralised management; and a territory, the catchment area (…).

Development of IWRM plans quickly became a positive factor for many donor-dependent developing countries seeking international assistance in the water sector. The United Nations-led Johannesburg World Summit on Sustainable Development (WSSD) of 2002, for instance, declared that all countries should "develop integrated water resource management and water efficiency plans by 2005" (United Nations, 2002, Article 26). This was a boost to countries such as Burkina Faso[3] that had already embarked on water policy reforms in the late 1990s with assistance from international technical and financial agencies. But, on the other hand, the timeline also stretched the resources of all stakeholders, including governments and donors, who had little previous experience in developing and implementing IWRM plans.

For many African countries in particular, moving from IWRM theory to practice posed major challenges. Even in South Africa, often considered as a model for explicitly incorporating IWRM principles in water legislation, difficulties in the implementation of the IWRM reform still persisted after 10 years (Shah and van Koppen, 2006). Basin agencies and local water fora that were meant to be the cornerstones for redressing past inequities concerning water sharing under the former apartheid regime are still regarded as weak institutions. For example, poor farmers in the countryside still encountered difficulties in gaining access to water whereas mines have maintained their privileges in this regard (de Lange et al., 2005; Merrey et al., 2009). Furthermore, the inequity in access and sharing of water was aggravated by the differences in lobbying power and economic importance between users, such as between poor smallholder farmers and high-tech commercial farmers in South Africa (Lévite and Sally, 2002).

Such gaps between theory and practice led researchers to question the notion of IWRM itself and its application. As Molle (2008) explains,

> the GWP definition[4] emphasises the three desired 'E's (Efficiency, Equity and Environmental sustainability) but implies that they can be achieved concomitantly, implying as the word 'maximise' suggests that problem solving can be informed by neutral and rational approaches, good science and expert knowledge (…) Little if anything in this definition suggests that the three goals of IWRM are frequently, if not always, antagonistic (hence the conflicts), and that trade-offs are necessary and hard to achieve in such situations.

[3] The Preface of the IWRM Action Plan (MAHRH, 2003) explicitly mentions that the adoption of this plan immediately after the WSSD declaration puts Burkina Faso in the leading group of countries in this regard.

[4] The Global Water Partnership (2000) defined IWRM as "a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".

Burkina Faso is often cited in the literature as 'a pilot country' in the implementation of IWRM (Petit and Baron, 2009). But some shortcomings of the reform have been highlighted by Petit and Baron (2009), notably i) a confusing institutional framework with water that was, for a long time, shared by two ministries (Agriculture and Environment);[5] ii) a weak implementation of the plan; iii) a lack of adaptation to local conditions; and iv) limited consideration of linkages between land and water (tenure). While recognising certain implementation shortcomings, the government also calls for recognising progress to date. For example, ten years of experience with regard to the establishment and functioning of local water management fora (called Comités Locaux de l'Eau or CLE) that had been entrusted with the responsibility for water allocation at sub-basin level (MAHRH, 2007a), and more recently the establishment of five river basin agencies in the country. To further consolidate these gains, the government and its partners are implementing a second phase of the IWRM action plan, building on the lessons of the first phase. The present focus is on enhancing coordination and implementation, while the previous phase was much more about 'putting the institutions right'.

This paper sets out to analyse local water management practices and impacts around small reservoirs in Burkina Faso in the context of the country's policy of actively pursuing the promotion of IWRM. A review of the water resources situation in Burkina Faso highlights the special role and place occupied by small reservoirs and irrigation in the country. The practical difficulties that arise in attempting to reconcile the imperative of making the most productive use of reservoir water with the other two fundamental principles of IWRM, namely, equity and sustainability, are discussed. Evidence provided by two case studies suggests that despite mechanisms that were meant to promote fair access to and sharing of reservoir water resources, such as the establishment of the CLE, the stronger role-players tend to dominate decision making within these fora.

WATER RESOURCES IN BURKINA FASO: SMALL RESERVOIRS, IRRIGATION, AND IWRM

Water storage and uses

The mean annual rainfall in Burkina Faso is around 750 mm with marked differences from North to South. The Sahelian area in the North receives less than 600 mm rainfall annually, the Sudano-Sahelian zone between 600 and 900 mm and the Sudanian zone in the south between 900 and 1200 mm. The rains typically occur between April-May and September-October but are characterised by large spatiotemporal variability, with important consequences for (rainfall-dependent) agro-pastoral production.

Climate-related stress is likely to worsen in the future, as a gradual trend of increased aridity has been observed, with a decrease in the length of the growing season by 20 to 30 days and a southward shift of the 100 mm isohyet (MAHRH, 2006). Boelee et al. (2009) explain that in spite of the decreasing trend in rainfall since the droughts of the 1970s, the run-off coefficient has paradoxically increased. This results in increased discharge (Mahé et al., 2005) and consequently a greater vulnerability to flooding, as has been observed in 2009 and 2010.

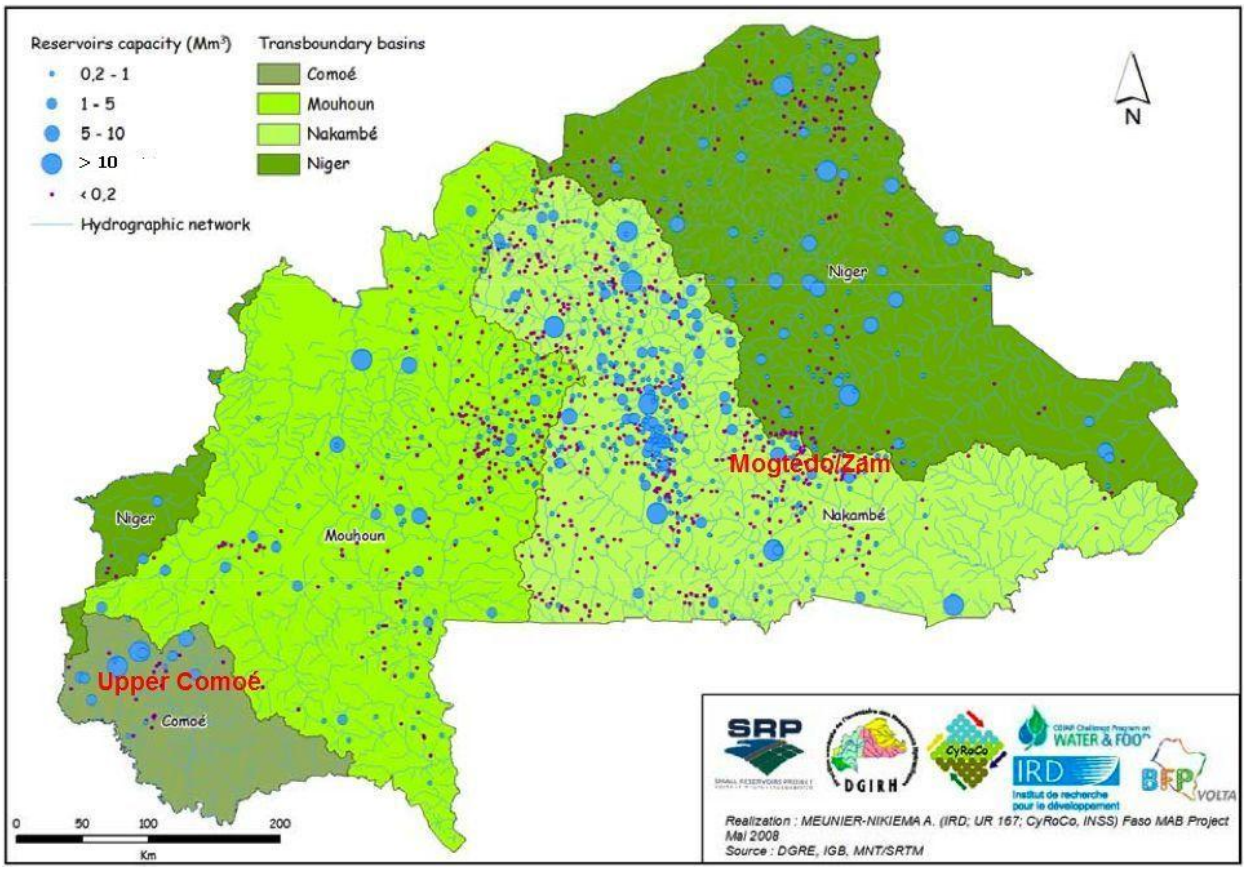
In such a context of uncertainty, small reservoirs[6] have long been identified as a promising option for water resources development, also because there are few large perennial rivers in Burkina Faso. The country has witnessed sustained construction of small reservoirs over the last century. The exact number and condition of these reservoirs, dams and their associated irrigated schemes are not known. Cecchi et al. (2009) estimated that there are between 930 and 1400 reservoirs in the country (see figure

[5] This is, however, no longer the case as the water (and sanitation) sector is under the remit of the Ministry for Agriculture and Water Resources.

[6] Defined by Boelee et al. (2009) as reservoirs with a dam height less than 10 m.

1).[7] These reservoirs are able to retain an estimated 36% of the annual surface water flow (Boelee et al., 2009, citing DIRH, 2001), thus showing the scope still available for further development of water storage.[8]

Figure 1. Main basins, distribution of reservoirs and case study locations (in red characters).



Source: Adapted from Cecchi et al., 2009, based on DGRE database 2001.

The grey bar of figure 2 shows that between one third and one half of all small dams in Burkina Faso were constructed by the government between 1974 and 1987, largely in response to the Sahelian droughts of the early 1970s and 1980s. The early 1980s also corresponded to the period when the political leadership of Burkina Faso undertook large infrastructural construction projects, including roads and railways, while promoting mass mobilisation of the Burkinabè population.

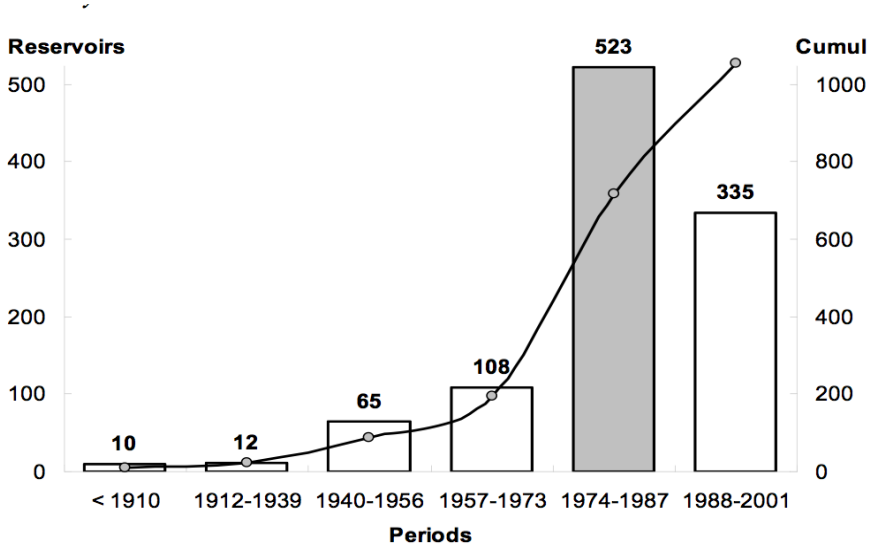
Many of these reservoirs were initially built to provide drinking water and cater for livestock watering (Opoku-Ankomah et al., 2006) but the development of irrigated agriculture around these reservoirs soon followed (Venot and Cecchi, 2011). The main consumptive uses of the stored water are

[7] The water resources directorate (DGRE) of the Ministry of Agriculture and Hydraulics has compiled a database of dams and reservoirs but it needs to be updated to include important information such as their present condition, uses and modes of management as major changes have occurred since their construction.

[8] Burkina Faso's annual total internal renewable water resources endowment is 12.5 km^3 (FAO-Aquastat, 1995). Only about 1 km^3/year is withdrawn for domestic, industrial and agricultural uses combined (FAO-Aquastat, 2011).

for irrigation (64%), domestic purposes (21%) and livestock (14%) (MAHRH, 2003). Hydropower is also produced in the larger reservoirs such as Bagré (1.7 km^3 capacity) and Kompienga (2 km^3 capacity).[9]

Figure 2. Timeline of dam construction in Burkina Faso (from Cecchi et al., 2009).



It must, however, be noted that as many of the reservoirs are more than 30 years old their actual storage capacities are likely to have decreased on account of sedimentation. Reduced storage capacity will not only give rise to greater competition for the available water resources among the different users but also adversely affect the flood protection function of the dams. In the recent past (in 2006, 2009 and 2010) extreme rainfall (with daily precipitation of nearly 300 mm) resulted in the destruction of several small dams (Demonfaucon, 2011) with dramatic consequences on livelihoods. Aware of the crucial importance of dam maintenance and the management of water resources in small reservoirs, the Government of Burkina Faso is implementing several programmes of rehabilitation of dams and reservoirs accompanied by suitable downstream development with the support of various international donor agencies (see for example, MAHRH, 2010).

Agriculture has always been a priority for the government, and the construction of irrigation facilities has played a critical role for several decades. However, out of an estimated irrigation potential of 233,500 ha, a little over 32,000 ha are under some form of agricultural water management of which only about 20,000 ha are said to be effectively cultivated annually (MAHRH, 2006). But reliable statistics are not readily available and the provisional results of the latest agricultural census (MAHRH, 2009b) indicate that there were about 26,000 ha of rice and 34,000 ha of horticulture crops in 2007 – the latter are mainly irrigated from shallow wells, reservoirs and streams. This points out to a thriving informal irrigation sector that appears to fall outside the remit of the mainstream public-supported irrigation sector. Though beneficial in many ways, notably through enhanced livelihoods, the development of informal irrigation poses an additional challenge to the management of small reservoirs as it is accompanied by new claims on the resource. It has also been shown that water monitoring and performance evaluation are generally lacking.[10] There were also high risks of infrastructural degradation

[9] Hydropower accounts for only about 15% of the installed electricity capacity of the country but plans are underway to augment this proportion, notably through the construction of several new dams.

[10] Based on the participatory performance diagnosis of several irrigation schemes conducted by the West African Irrigation Project (WAIPRO). WAIPRO is an on-going (2009-11) research-development programme jointly implemented by IWMI, CILSS and national partners in Burkina Faso and Niger. More information on WAIPRO is available at http://waipro.iwmi.org/.

and crop failure due to poor maintenance and the occurrence of extreme events. Furthermore, there is increasing competition over water resources among different user groups, sometimes leading to situations of dispute and conflict (CNID-B, 2010a, 2010b). Further, problems are not limited to water management within irrigation schemes but concern the entire catchment. For example, inflows to the reservoirs get altered on account of population growth and changes in land-cover and land-use practices, such as the development of informal irrigation. In this context, issues related to the storage, allocation and productive use of water resources to meet the growing demand of agriculture (which accounts for more than 60% of the country's total annual water withdrawals) and the municipal sector[11] become crucial. The effective implementation of IWRM, as a vehicle for reconciling the multiple, and often competing, water uses, thereby assumes even greater relevance.

Promoting Integrated Water Resources Management (IWRM)

Article 14 of the 1991 constitution of Burkina Faso states that natural resources belong to the people and should be used for improving their living standards.[12] Recognition of water as a public good is thus enshrined in the constitution itself. Burkina Faso started a process of water reform in the late 1990s and this was reinforced by the water management law of 2001[13] which explicitly supported the introduction of the principles of IWRM to guide the country's water management efforts. The action plan to promote the implementation of IWRM (called PAGIRE) was adopted under Decree no. 220 of 2003.[14] The PAGIRE programme is now in its second phase (MAHRH, 2009a) covering the period 2010-2015, following the initial pilot phase between 2003 and 2009.[15]

As part of the process of adoption of IWRM, the Government of Burkina Faso has progressively put in place water management entities at different levels, from local to basin scale, including the creation of five basin agencies (in the five national river basins) that will be responsible for managing water within their respective basins. In addition to other functions, these agencies are expected to carry out active policing of water use. A parafiscal tax from all water users has also been proposed to generate some financial resources for the functioning of these agencies.[16]

In terms of decentralised entities at the local level, and central to the first phase of the PAGIRE, was the establishment of Local Water Committees (CLE). A CLE is supposed to act as a local-level forum for consultation among all stakeholders with an interest in water management in a given sub-basin. As stated by Roncoli et al. (2009), the CLE would function "as platforms for consultation, mobilisation and promotion rather than a decision-making body with enforcement prerogatives". It is made up of representatives from the state (both administrative and technical), water users, civil society and local authorities (communes or municipalities). More than 30 CLE have been set up in the country but a recent review (MAHRH and BEGE, 2008) highlighted that a majority of them have actually been set up to manage water stored in a reservoir or a lake rather than in a sub-basin as originally intended. The review also concluded that the capacity of the CLEs to effectively execute their responsibilities remains weak. The study recommended strengthening the capacity of the CLEs regarding conflict resolution, participatory planning and multi-stakeholder dialogue, fund raising, and IWRM.

On the other hand, at the basin level, the agencies are expected to be better resourced both in terms of finance and human capacity and also possess powers of enforcement ('water police'). The

[11] Municipal water withdrawal in Burkina Faso has increased from 8.3 m^3/capita/year in 1997 to 21.5 m^3/capita/year in 2005. www.fao.org/nr/water/aquastat/data/query/results.html

[12] www.legiburkina.bf/codes/constitution_du_burkina_faso.htm

[13] La loi n°002-2001/AN du 08 février 2001 portant loi d'orientation relative à la gestion de l'eau.

[14] Décret N° 2003-220 /PRES/PM/MAHRH portant approbation du plan d'action pour la gestion intégrée des ressources en eau (PAGIRE).

[15] As a matter of interest, the cost of the first phase of PAGIRE was estimated by Petit and Baron (2009) at 13.5 billion CFA Francs (€20 million), mainly financed through Danish and Swedish bilateral assistance.

[16] A law in this respect ('*Contribution Financière*') has recently been passed and is awaiting the promulgation of the decree of application.

basin agency is a public establishment endowed with legal identity and financial autonomy (MAHRH, 2003). Among its tasks, the basin agency will prepare master plans for water development and management (i.e. Schémas d'Aménagement et de Gestion des Eaux, SAGE, and Schéma Directeur d'Aménagement et de Gestion des Eaux, SDAGE) and organise basin management committee meetings. This management committee is composed of basin-level representatives of: (a) users, (b) local communities, and (c) the state. The committee shall approve the master plans and all related interventions in the basin. Already one basin agency has been set up (Nakanbé in 2007) and the creation of two others (Mouhoun and Cascades) is underway. In the new framework (second phase of PAGIRE) the CLE will have to consult and inform their basin agency about all management operations at sub-basin level. The role of the basin agency will be more focused on implementing the master plans, providing technical advice, and sharing of information but for obvious reasons (making optimum use of available human resources, decentralisation) they will continue to use the CLE as instruments for managing water locally. In the event of problems, the basin agency would be expected to look for solutions, such as organising water police interventions if required.

SHARING WATER AT THE LOCAL LEVEL: EVIDENCE FROM TWO CASE STUDIES

Background

The two examples described in this paper were studied as part of the WAIPRO research-development project referred to earlier. They were chosen because they illustrate the practical challenges typically faced in the management of small reservoirs in the context of local-level IWRM implementation in Burkina Faso. The information and results used in this paper were collected in the course of the two year existence of the WAIPRO project. Most of the data were collected using the Participatory Rapid Diagnosis and Action planning (PRDA) method (Van der Schans and Lemperière, 2006) and later supplemented by further detailed investigations. The PRDA approach[17] is well regarded in the region, with dozens of national experts already trained through the regional irrigation and drainage association (called RAID/ARID). Farmers are closely involved throughout the process to enhance their ownership of the findings. It is worth highlighting that during the PRDA, open questions were also put to farmers and managers with the aim of providing the opportunity to stakeholders to freely formulate any views, both favourable and critical, about the functioning of their scheme (CNID-B, 2010a, 2010b).

The two examples studied have similar development trajectories. Both of them include dams, reservoirs and downstream irrigation development. They were constructed by the Government of Burkina Faso with technical and financial assistance from external donors (Chinese then Taiwanese in one case, and French in the other). In both cases there has been a progressive increase of irrigation over the last decades due to the expansion of formal farming (with private or public funds) and/or an increase in the number of informal irrigators who have developed activities around the reservoirs or even along rivers and canals downstream of the dams. One finding of the PRDA common to both schemes was the degree of frustration felt by some water users who explained they were ready to "fight against" the informal irrigators whom they considered as their "enemies". In one case, the farmers even declared that they would rather see the dam full of sediment than allow their competitors to make use of the water (Ndanga-Kouali, 2010). In the other case, the irrigation farmers are resentful that they had to relocate away from their former lands to make way for a large commercial plantation,

[17] The PRDA methodology is broadly made up of five main phases: (1) preparation and collection of available secondary data and information, and choice of method of analysis, (2) collection of field data, (3) performance analysis and diagnosis, including problem ranking by farmers, (4) solution identification and assessment, and (5) presentation of results, discussions with stakeholders and agreement on action plans. It is typically carried out by a multidisciplinary team that includes specialists in agricultural water, agronomy, economics and sociology and involves interactions with stakeholders at all levels, from farmers at the field and scheme level to representatives of the management agencies at system and sub-basin level (Van der Schans et al., 2006).

thereby also losing access to water (Cour, 2010). Conflicts over access to, and use of, water access and use are common in Burkina Faso (Opoku-Ankomah et al., 2006) but these two cases forcefully underline the fact that such conflicts are grounded in inadequate dialogue, perceived inequities and lack of transparency. The following sections will discuss the extent to which the implementation of IWRM through the setting up of a CLE, which seeks to promote the principles of efficiency, equity, transparency and environmental sustainability, has been successful in redressing such a situation in the two case studies.

The Upper Comoé basin: Where strategic commercial interests dominate

The Comoé is a perennial river in the extreme south-west of Burkina Faso where the annual rainfall exceeds 1000 mm. The source of the river is in a wild, mountainous area while the lowlands have been an area famous for traditional rice cultivation. The region (called Cascades due to the abundance of water) is one of the more economically vibrant regions of Burkina Faso with several food processing industries installed near Banfora, a town of 70,000 inhabitants on the Abidjan-Ouagadougou road and railway routes. In the 1970s, the government began to put in place the infrastructure to support what is today a sugar cane irrigation scheme of 4000 ha. Around the same time, construction was initiated on the Karfiguéla rice irrigation scheme to settle farmers ousted from lands now occupied by the sugar cane plantation. Three dams were also constructed in the area between 1976 and 1991 on the Comoé and Yanon rivers to secure sugar production and also guarantee the municipal water supply to the town of Banfora. Figure 3 is a map of the Upper Comoé case study area.

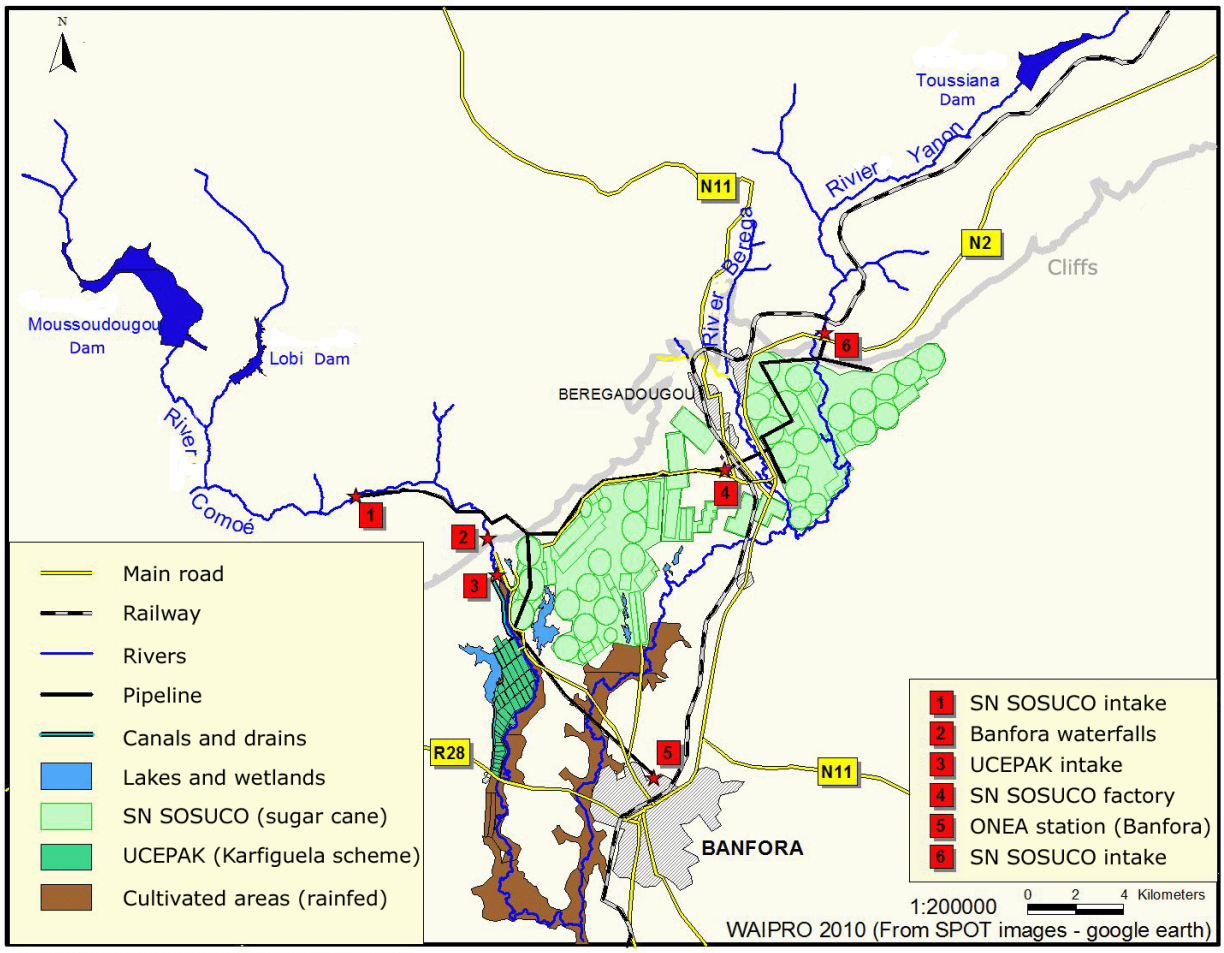
Some 12 years ago, the government privatised its sugar cane industry. A foreign company (Industrial Promotion Services, IPS) acquired the plantation and factories; but the government kept some shares in this entity renamed as Société Nouvelle-Société sucrière de la Comoé (SN-SOSUCO).

The state also allowed the very same private company to manage the reservoirs that supply water to its sugar cane fields as well as to the other users. The dams are still the property of the state but SN-SOSUCO has almost total control over water allocation. As part of the agreement regarding reservoir management, the company is expected to release water to meet the domestic water requirements of the Banfora town as well as release a so-called 'environmental flow' of 150 litres per second (l/s) to serve all other downstream users. This is not an easy task for SN-SOSUCO, especially in light of the uncertainty regarding future water availability (Roncoli et al., 2009). As stated by Roncoli et al. (2009): "decisions are done conservatively to minimise potential deficits later in the year. So downstream water shortages are experienced even after years of good rainfall, as was the case in 2007, despite good precipitation during the previous rainy season". Therefore, it is not surprising that farmers from the Karfiguéla irrigation scheme (most of whom are those displaced over 40 years ago to make room for the sugar cane fields) perceive that their needs are the last to be met. They also argue that they deserve more water as they have little opportunities for farming outside the irrigation scheme.

A water management committee has been in existence in the Comoé for more than 10 years (MAHRH and BEGE, 2008). The inaugural meeting was held in April 1992, with a total of 4 meetings held that same year. Thereafter the committee met regularly, at least once a year, up to 1999 with the exception of 1997 (AEDE, 2004). It functioned as an effective consultative forum of all water stakeholders to address issue such as: (a) conflicts related to water-sharing between SN-SOSUCO and other water users; (b) meeting the growing municipal water demand with the limited resources available for public investments; and (c) concerns about possible adverse impacts of irrigated agriculture and industrial activity on water resources and ecosystems. SN-SOSUCO functioned as the focal point from all angles, economic, political and social (AEDE, 2004). In December 1999 the regional government authorities decided to give formal legal recognition to the committee. The regional office of the Ministry of Agriculture and Water was designated as the permanent secretary of the committee. According to AEDE (2004), there had been no meetings since the inaugural session of this 'new' body in

December 1999, this being attributed to failure on the part of the secretariat to execute its responsibility of 'animator'.

Figure 3. Main water bodies and water users of the Upper Comoé river (modified from Cour, 2010).



Given the strategic economic and social importance of sugar production for the country, the position of SN-SOSUCO as the biggest employer in the region, and the emergence of tensions among water users, the government gave high priority to restructuring this water management committee into a CLE. A civil society organisation, AEDE (Association Eau, Développement et Environnement) was hired by the government to provide technical assistance during this transformation. The restructuring process took 13 months and the CLE-Upper Comoé was officially established in May 2008 (MAHRH and BEGE, 2008).

Even though Karfiguéla farmers are represented within the CLE (and its predecessor), they hold the view that they do not receive an equitable share of water resources especially during the dry season, thereby compelling them to limit double cropping to only certain areas of the irrigation scheme. In 2007, their frustration grew to the point where Karfiguéla rice producers marched in protest to local government premises. A cursory look at the membership and functioning of the CLE can explain this widely shared frustration. The CLE is chaired by the President of the Regional Council. Regional heads of state agencies (e.g. Agriculture, Water Supply) are represented as well as the mayors of the *Communes* (municipalities) and some local NGOs, all highly educated and holding positions of significant responsibilities. It is then not surprising that the Karfiguéla farmers, the majority of whom do not read and write, feel they are highly disadvantaged in the presence of the representatives of the powerful

sugar industry and other stakeholders during CLE meetings. General assembly gatherings are held annually but a smaller Technical Committee (TC) meets several times a year. While general agreements in respect of (seasonal) water allocations are made during the general assembly, review of progress and decisions about any adjustments are taken within the TC (for example in case of insufficient rains). The government maintains that it keeps an eye on the decisions regarding water sharing in the region through the meetings of the CLE and the de facto technical support and supervision that the regional office of the Ministry of Agriculture and Water provides to organise the CLE meetings. But, in reality, SN-SOSUCO remains the dominant player. It provides technical information and financial means for field visits to the technical committee members. It also has significant economic clout, being the country's largest private-sector employer and generating substantial revenues in the region.

During a meeting in 2010 the SN-SOSUCO indicated that it would be willing to release more water to the Karfiguéla irrigation scheme but on the sole condition that rice irrigators manage their allocation more efficiently. The observed poor management of the scheme – reinforced by the absence of water flow measurement and monitoring – appears to be used as an 'opportunity' to maintain the status-quo beneficial to SN-SOSUCO and is regularly put forth to justify water allocation on the grounds of economic efficiency and job creation. Referring back to the suggestion by Molle (2008) that the implementation of IWRM often entails trade-offs between the three 'E', this is an example where the trade-off is between (economic) efficiency and equity. However, table 1, which is an attempt to simulate and compare the relative returns over a growing season between the rice irrigation scheme and the sugar cane plantation, shows the limitations of such economic reasoning, depending on the vantage point considered.

Table 1. Comparing the relative returns to rice and cane cultivation.

	Unit	Karfiguéla rice	SN-SOSUCO sugar
Area	Ha	350	4000
Production x 1000	tonnes	1.4	30
Unit value	dollars/kg	0.45	1.40
Value of production	100 US$	560	42,000
Jobs		730	3700
Water use per ha (diverted)	m^3/ha	15,000	16,000
Water productivity (diverted water)	kg/m^3	0.27	0.47
Water productivity (diverted water)	dollars/m^3	0.12	0.66
Jobs/ million m^3		139	58
Theoretical crop water requirement (depleted water) [18]	mm	1020	2020
	m^3/ha	10,200	20,200
Water productivity (depleted water)	kg/m^3	0.39	0.37
Water productivity (depleted water)	dollars/m^3	0.18	0.52
Jobs/million m^3		204	46

It is clear that the performance of SN-SOSUCO is far superior to that of the Karfiguéla irrigation scheme in every respect but the 'jobs per drop' indicator. Although SN-SOSUCO provides over five times more jobs than Karfiguéla in absolute numbers, it appears that Karfiguéla does better in terms of the jobs provided per unit of water (and even more if informal farmers around the schemes are also taken into

[18] Based on personal communications with D. Ouattara (Irrigation service of SN-SOSUCO) and Y. Dembele (Rice research programme of INERA, and presently with Africa-Rice), September 2011.

account). In addition, the drainage from the schemes[19] flows into the Karfiguéla wetland or into the Comoé river to be reused by informal irrigators further downstream. This raises the question of which indicator to use when assessing the value of water and reinforces the need to balance financial and economic objectives against those of equity when evaluating and interpreting performance. This could also be an argument in favour of releasing more water to the Karfiguéla irrigation scheme because it would allow dry-season cropping of the entire Karfiguéla scheme thereby creating more jobs. The table also shows that the Karfiguéla farmers could strengthen their case if they demonstrate their ability to better manage their irrigation water – water productivity is currently about 50% lower than the theoretically attainable levels. We might note that the ratio of water productivity ($/m^3) between SN-SOSUCO and Karfiguéla, which is approximately 3:1 or 5:1, according to whether it is based on the theoretical crop water requirements (depleted water) or the reservoir water releases (diverted water), is comparable to the 4:1 ratio obtained in a 2007 study of water resources utilisation in south-west Burkina Faso (MAHRH, 2007b).

The above observations point to the need for greater engagement and commitment of local government (municipalities) and local-level representatives of state agencies and of farmers to promote a more equitable and level playing field related to water allocation. Factors to be considered notably include:

- redressing past inequities (Karfiguéla farmers were expelled from their land);
- ensuring local food security versus national economic imperative (favour rice or sugar cane cultivation);
- the need for systematic monitoring and evaluation (assess water quantities delivered to each user and effective consumption by evapotranspiration).

The mandate, roles and responsibilities of SN-SOSUCO in regard to water allocation and management must be more explicitly defined and be subject to greater degree of monitoring and oversight by the state, which after all is still the sole investor and owner of the dams and associated infrastructure.[20] Herein lies the need to find the right balance between state control, private interests and downward accountability towards less-powerful stakeholders such as farmers.

Mogtedo-Zam: A case of domination from downstream

The case of Mogtedo-Zam illustrates an unequal power-play and a perceived injustice concerning water sharing between different groups of farmers, some more powerful than others. The site is located in the Nakambe river basin, some 90 km east of Ouagadougou in the Central Plateau region. The mean annual rainfall is about 800 mm, but with high inter-annual differences (Padounou and Sarr, 2009).[21]

Before the construction of the Mogtedo dam, the inhabitants of the commune of Zam (including the small village of Talembika; see figure 4) used to cultivate rain-fed millet and sorghum in the lowlands. The construction of the dam in 1963 compelled the local communities to give up cultivation on their traditional fields, losing about 900 ha of lands. The Talembika villagers were particularly affected because the topography (small hills not far upstream of the reservoir boundaries) limited possibilities for expansion of rain-fed cultivation to alternative land. However, the creation of this 6.5 Mm^3 water storage facility transformed the economy of the area (Dembele et al., 2010), especially after 1968 when

[19] We do not, however, yet have a quantitative estimate of the magnitude of the drainage flows and what proportion of it is actually reused for downstream farming.

[20] The importance of the State is further illustrated by the fact that it is called upon by SN-SOSUCO and other stakeholders to address the structural problem affecting the Moussodougou dam (figure 3); investigations, with a view to remedial action and rehabilitation, are currently underway. www.lepays.bf/?barrage-de-moussodougou (accessed 11 August 2011); www.lefaso.net/spip.php?article43405 (accessed 10 August 2011)

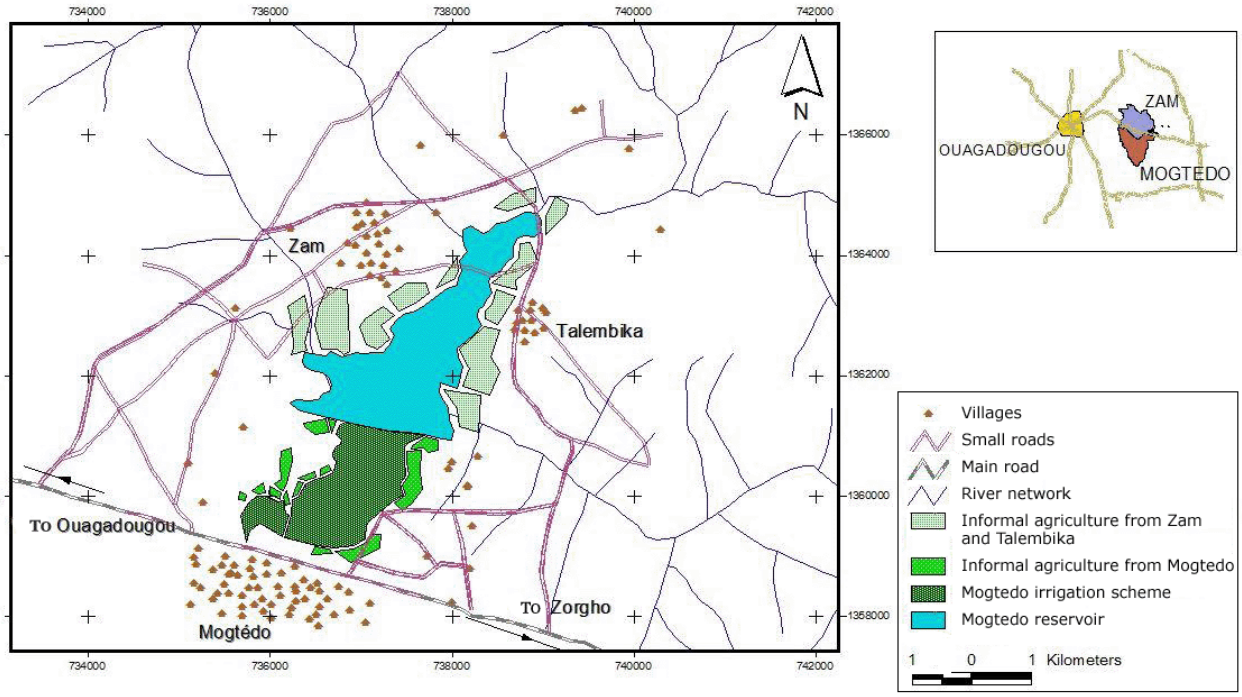
[21] According to Padounou and Sarr (2009) the inter-annual differences ranged from 578 mm to 1273 mm in the period 1992 to 2005.

the 110 ha Mogtedo rice irrigation scheme was established downstream of the dam. Subsequently, another 100 ha of additional land were progressively brought under cultivation around the formal irrigation scheme by informal irrigators who installed pipes and pumps to extract water from the canals. At present, these farmers are no longer considered as 'illegal' and share the water intended for the irrigation scheme with some level of tolerance from the farmer cooperative[22] that is responsible for managing the irrigation scheme, including reservoir water releases.

Altogether 378 farmers are estimated to derive their livelihoods from the formal irrigation scheme alone and Mogtedo is portrayed as a success story in the country.[23] One indicator of this success is the fact that buyers from neighbouring countries such as Togo or Ghana come to Mogtedo regularly to buy high-quality vegetables, mainly onion and tomato. The farmers are able to engage in double-cropping, with rice being the main crop during the wet season and a mix of rice and horticultural crops being grown in the dry season. Rice yields easily reach 5 tons per ha twice a year.

In addition, a substantial amount of cereal and horticultural crops are grown all around the reservoir upstream of the dam, the latter being irrigated through direct pumping from the reservoir. The Mogtedo reservoir is estimated to support around 477 ha of irrigated area (including the 100 ha of informal irrigation in the Mogtedo scheme) (Padounou and Sarr, 2009; Ndanga-Kouali, 2010).

Figure 4. Irrigated areas dependent on the Mogtedo-Zam reservoir (Ndanga-Kouali, 2010).



The spontaneous expansion of irrigation is clearly driven by the commercial dynamism of the Mogtedo market which provides a favourable outlet for the sale of agricultural produce.[24] Two other factors also appear to have contributed to this expansion: a tolerance on the part of the state by overlooking

[22] Irrigators are expected to pay a communal tax of 2000 FCFA (about US$4) per motor pump. Mogtedo farmers are expected to pay an irrigation service fee to the cooperative in addition to this communal tax.

[23] Le bel exemple de la coopérative de Mogtedo. Fenop-Info No. 4. www.abcburkina.net/ancien/fenop/fenopinf_4.htm

[24] However, this does not mean that the so-called informal farmers upstream of the reservoir are not undergoing any hardship. Water is available to them only during part of the year and they have to also bear the costs of operating and maintaining their pumps.

irrigation development in the vicinity of water bodies (ignoring the 100 m activity-free zone required by legislation) and an increase in the number of motor-pumps (a consequence of a major reduction in their purchase price). Once again we see an illustration of the trade-offs among the three 'E's of IWRM, with equity and long-term sustainability losing out to immediate economic gains.

As was the case in the Comoé system, today, especially during periods of water stress, frustration and tensions run high among water users. With increasing uncertainty, frequent extreme events, and decreasing storage availability due to sedimentation the pressure on the water resources is likely to increase, resulting in a higher possibility of conflicts. A recent study (Mvondo-Ayissi, 2010) revealed that some farmers of Zam even wish for a return to the pre-dam situation (they 'hope' for the silting up of the reservoir), so that they may recover the lands they had previously occupied. Each group is denigrating the other. Upstream users in particular are criticised for their irrigation practices that are said to encourage sedimentation of the dam and pollution – reproaches that have been echoed by a national newspaper (Sidwaya, 2008, 2010). Ndanga-Kouali (2010) estimated that siltation has probably reduced the useful capacity of the dam to around 2 to 3 Mm^3 (compared to the initial 6.5 Mm^3) although these figures need to be confirmed after more detailed investigation.

The different studies conducted on the area have brought to light a series of other issues that are a potential source of disputes, conflicts and claims – and can only be exacerbated by increasing uncertainty regarding water availability (in 2008, the reservoir ran completely dry while in 2010, violent floods were recorded):

- the quality of water is a concern due to the extensive use of pesticides by the horticultural producers (Ndanga-Kouali, 2010);
- fishermen from Zam are accused by Mogtedo farmers of 'disturbing' the water by their activities (Ki et al., 2010);
- similarly, upstream users accuse downstream farmers, members of the Mogtedo cooperative, of abusing their control over dam water releases and opening the reservoir control gates and drawing too much water; moreover, it seems that the reservoir water is also released for use (illegally) about 3 kilometres further downstream by vegetable fields (Ndanga-Kouali, 2010);
- in addition, the upstream users do not consider the downstream informal irrigators as legitimate even though the latter are now more or less integrated into the Mogtedo irrigation scheme (Ndanga-Kouali, 2010);
- livestock keepers are also unhappy since their access to water is becoming increasingly difficult (Ki et al., 2010).

The decision by the government to set up a CLE with specific jurisdiction over the Mogtedo reservoir (and not a sub-basin, the usual unit of responsibility of the CLE) has been motivated by a desire to address the numerous water-related conflicts that the existing local-level organisations and mechanisms (e.g. the reservoir management committee, irrigators committee, on all of which the Mogtedo cooperative has a preponderant position) were apparently unable (or unwilling) to resolve and were threatening to adversely affect the Mogtedo success-story.[25] The CLE-Mogtedo was officially established in May 2006 (MAHRH and BEGE, 2008).

But according to a recent analysis (Ki et al., 2010) the control over this CLE is in the hands of the downstream users of Mogtedo. The president of the Cooperative of Mogtedo seems to have extensive authority as he is also the president of the CLE in addition of being the president of the Mogtedo reservoir management committee. Moreover, the office-bearers (the 'bureau') of the CLE are practically the same as those of the Cooperative of Mogtedo (Ki et al., 2010). Very few water users from the

[25] The site is located near the country's capital city and is often visited by international organisations, universities, NGOs and development professionals for its dynamism and vibrancy.

Talembika village are aware of the water management decisions, which is not surprising given that even members of the bureau of the CLE who are from Talembika are not invited to all CLE meetings. Ki et al. (2010) explain that categories such as women, youth and livestock keepers appear to be particularly excluded because of a perceived fear of contestation from these groups. Of a total of 30 groups of water users who are members of the CLE, only 13 have paid the membership fee of 10,000 FCFA (Ki et al., 2010). There is no evidence of the CLE having made efforts to collect these dues, perhaps reflecting the difficulties it faces in enforcing decisions. This may also be a possible reason for the lack of involvement of certain user groups in the CLE.

There is general criticism of the CLE for its lack of transparency, the non-presentation of reports of activities and financial reports and the low frequency of meetings.[26] It is therefore not easy to obtain information about the functioning of the CLE.

A striking feature of the Mogtedo CLE is the ill-representation of the state although the role of state agencies is clearly described in the relevant legal texts. In fact the Mogtedo water users view the CLE as a purely farmers' organisation and consider that other role-players, notably representatives of the government administrative and technical services, should not get involved unless a particular situation warrants their intervention. As a result, decisions generally tend to be made unilaterally by the water users (MAHRH and BEGE, 2008).

The case of Mogtedo illustrates the confusion that reigns as a result of the multitude of water-related organisations that have been set up, often with overlapping mandates and the same sets of key office-bearers. The absence of coordination leads to frustration and lack of transparency without necessarily achieving the ultimate aim of improving water resources management.

REDRESSING THE STATUS QUO: PROSPECTS FOR THE FUTURE

The Government of Burkina Faso is actively pursuing the implementation of IWRM within the context of a national water policy and legal framework that, inter alia, recognises the principle of subsidiarity and the river basin as the unit for planning and managing water resources. The IWRM action plan makes provision for setting up water authorities and management entities at different levels. At the lowest level of subsidiarity are the sub-basin and the Local Water Committee (CLE). The implementation of the second phase of the country's IWRM Action Plan (PAGIRE), currently underway, affords opportunities to learn from past experience and improve local water management within an IWRM framework.

IWRM implementation in Burkina Faso has been synonymous with the management of reservoirs and other water bodies, and hence with irrigated agriculture. This is not surprising given the prominence of reservoirs (more than 1300) in the country and their crucial contribution to its water and food security. It also reflects the concern of the government to minimise conflicts and ensure the sustainable and productive management of these water bodies. The decision to initially focus the responsibility of the CLE on reservoirs and not on sub-basins may also be viewed as a first step in IWRM implementation and a 'training ground' prior to scaling up to the higher level.

The two examples discussed in this paper highlight some of the challenges faced in implementing water management reform in the country, particularly with regard to perceptions of fairness and equity related to water sharing. The case studies also confirm the findings of MAHRH and BEGE (2008) and Petit and Baron (2009) referred to earlier.

It is observed that the CLE that have been set up, while nominally inclusive of all stakeholders, fail to adequately reflect the perceptions and concerns of the most marginalised, as evidenced by the situation of the farmers of the Karfiguéla irrigation scheme and the informal irrigators of Mogtedo-Zam. Local politics and lack of capacity are major stumbling blocks impeding water users and local government to assume their new and complex roles and functions under this new dispensation. For example, the Mogtedo CLE would be well-advised to review its position of not involving state agencies,

[26] There have been just 6 meetings in 4 years; and no meeting in 2010.

which would otherwise be able to provide the necessary technical assistance to better manage the reservoir, especially in terms of estimating seasonal demand and inflows, enforcing water management decisions and the recovery of user fees, as well as assisting in conducting regular and inclusive meetings.

On the other hand, dominant water user groups seem to be able to use those new platforms to consolidate their influence and control over water allocation. Arguments such as the strategic nature and economic importance of their activity both in terms of both agricultural production and job creation are put forth to justify the privileged position of SN-SOSUCO in the Upper Comoé case.[27] In Mogtedo-Zam, dominance is exercised through control over the reservoir sluice gates and the de facto possibility of obtaining downstream water releases without consultation and consideration for upstream water users. There, local politics play out strongly as most initiatives aiming to organise users fall under the authority of the same powerful individuals. These findings bear out Warner et al. (2008) who argue that the choice of the river basin as the management unit is political and point out the limitations of multi-stakeholder platforms in implementing IWRM in such a context.

In these conditions, some stakeholders perceive the CLE as serving the interests of a privileged group of participants rather than benefitting the wider body of water users. So far, tensions among user-groups represented in the two CLE remain latent and have not broken out into open conflict. But during this research, many users expressed their frustration and a sense of powerlessness to alter the status quo. They claim that water allocation is biased towards those they perceive as more privileged than themselves. With rapid demographic growth, mounting pressure on access to natural resources, both land and water, and increasing climate-related uncertainty such issues will only tend to get worse.

In both the Upper Comoé and Mogtedo-Zam, as observed in many other areas of Burkina Faso, there are increasing numbers of informal water users, mainly irrigators, who extract water directly from the reservoirs, upstream, or from irrigation canals, downstream. Given the importance of this phenomenon in terms of food security and livelihoods, there is a need to clarify their status and to devise innovative modes of management that account for this diversity of users and the attendant environmental and equity issues. If indeed, they were to be granted some form of formal access to a share of the water resources, it would then be normal that they, in turn, submit to the same monitoring and control as other water users, and also contribute to the functioning of local-level organisations like the CLE as well as to the maintenance of the infrastructure.[28]

Evidence from the two case studies also points to the fact that simply setting up the CLE is not sufficient. Targeted accompanying measures should also be put in place to ensure effective functioning of the CLE and the achievement of its objectives. Such measures should ideally build on existing (or tacit) local informal water-sharing arrangements which should, wherever possible, be accepted, adapted and incorporated into any new mechanisms for water allocation. It is essential to strike the right balance of roles and responsibilities among all stakeholder groups represented in the CLE. The role of the state technical services in the CLE is particularly delicate. On the one hand, they are required to support, but not directly participate in, the decision-making process, which is expected to be primarily water user-driven and on the other hand, they remain reluctant to devolve their power and they find it difficult to remain passive when it becomes apparent that the management and decision-making apparatus of the CLE are underperforming or dysfunctional.

We also believe that the newly established basin agencies that are meant to have oversight responsibility over the CLE in their respective river basins should play a proactive role in building trust and promoting meaningful dialogue among stakeholders with a view to garnering consensus over water

[27] Roncoli et al. (2009) state "The state was instrumental in transferring rights over land and water resources from these local communities to private enterprise. This move might have been partly motivated by the prospect of development benefits, which, however, have largely eluded rural populations".

[28] The merits and demerits of securing the water rights of irrigation schemes in the context of an integrated basin management perspective (see for example, Tioro, 2007 and Sanou et al., 2010) are the subject of on-going national debate.

sharing in the catchment areas under their purview. This is especially important in contexts such as the Upper Comoé and Mogtedo-Zam where some parties have built up frustration as a reaction to past – and unresolved – inequities such as displacement and de facto eviction impeding their access to land and water. Furthermore, a regular two-way flow of information between the basin agencies and the various CLE under their responsibility will enhance the ability of the agencies to get an accurate overall perspective of water resources management both at local and basin levels. A culture of performance monitoring and assessment should thereby be promoted throughout the basin, most importantly, in the irrigation schemes. Very little has been done in this regard up to now. Such actions need not involve huge resources for a modest beginning and would include items like daily readings of reservoir levels, installing and reading staff gauges in canals or noting the openings of calibrated distributors ('modules a masque') if already existing. Where needed, the reservoirs and associated infrastructure should be equipped with at least some basic means of measuring and monitoring water (at least quantity) at key control locations with some degree of support and supervision of the relevant technical bodies of the state or the basin agency. The costs could be borne as part of the overall IWRM implementation programme, particularly the establishment of basin agencies and CLE.

Mere data collection is not enough but has to be followed by regular data and information sharing. This is an important step towards establishing mutual trust among the stakeholders of the CLE and minimising the likelihood of disputes and conflicts. Relevant training should be provided to members of the CLE in the processing and transfer of information, both horizontally and vertically, to support management. Currently, the different parties are not in a position to independently substantiate claims of excessive water use by others or of insufficient reservoir water releases for their benefit, and the availability of such data and information would provide an objective and transparent basis for discussions and decision making about water allocations during meetings of the CLE. This can only enhance the role of the CLE as a platform for discussion and conflict resolution at local level, while a direct link with the basin agency should strengthen the application of formal regulations, as the agency will have the requisite mandate and resources at a broader scale.

ACKNOWLEDGMENTS

The case studies described were undertaken as part of the West Africa Irrigation Project (WAIPRO). The funding support of the United States Agency for International Development (USAID), the excellent cooperation of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) where WAIPRO is hosted (http://waipro.iwmi.org/), and the wholehearted collaboration of WAIPRO's national partners in Burkina Faso are all gratefully acknowledged. We are also thankful for the constructive comments and suggestions received from the reviewers, particularly the patience and guidance of the co-editor, Jean Philippe Venot. The authors gratefully acknowledge the support of the International Water Management Institute.

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